

Effects of plyometric training on soccer related physical fitness variables of intercollegiate female soccer players

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Abstract. Plyometric training is an important training program in improving physical fitness and soccer skills of players. The study was conducted to find out the effects of plyometric training on soccer related physical fitness variables of Haramaya University intercollegiate female soccer players. For this study forty female (age, 20 ± 1.5 years; height, 1.61 ± 0.7 m; BMI, 20.41 ± 0.7 Kg/cm²) soccer players were selected through purposive sampling. Experimental group (n= 20) participants were engaged in a supervised plyometric training program 3 days/week for 12 weeks. The control group (n= 20) did not participate in any of the program except regular soccer training however, the tests were conducted for them. The physical fitness and soccer skill variables selected for the study were: Speed, Explosive power, Agility, Dribbling, Kicking Right and Left Feet. Tests were taken three times at pre training, during training and post training. Comparison of mean was done by paired t-test. The results obtained in this study indicated that there was significant improvement in selected physical fitness and soccer skill variables due to the effects of plyometric training. After 12 weeks of plyometric training participant's speed (0.78 m/sec.), agility (2.64 sec), and explosive power (7.85 cm) were changed significantly ($p < 0.05$). Participant's dribbling soccer skill (1.92 sec.), kicking right foot for distance (2.19 m) and kicking left foot for distance (2.91 m) were significantly improved through plyometric training. This study proved that plyometric training was significantly better in improving the physical fitness variables and soccer skills of female soccer players.

Keywords. Intercollegiate, physical fitness variables, plyometric training, soccer skills.

Introduction

Soccer (also known as football) is the world's most popular form of sport, being played in every nation without exception. Female's soccer is one of today's most popular sports, yet not so long ago, females were forbidden to play it. In fact, until fairly recently, it was still a male-dominated game. The popularity of women's soccer continues to grow as evidenced by the six to eight million female athletes between the ages of 6 and 24 years

playing soccer. Soccer requires athletes to perform short sprints, repeatedly change directions, and complete numerous jumps during a 90 min match (Krustrup et al., 2005; Stolen et al., 2005).

Plyometric training is a form of exercise that utilizes the body's stretch reflex and eccentric muscle contractions to enhance speed and power. Though explosive power contributes relatively little to aerobic performance, plyometric training helps develop general athletic ability, ballistic skills, kinesthetic awareness, rhythm and coordination. Soccer players, especially, can benefit from the development of the power and overall athleticism provided by plyometric exercise. Soccer players need to have the ability to respond quickly and powerfully on both offense and defense (Chapman et al., 2007).

Plyometric training has many advantages for the improvement of athletes overall performance in various sport events including soccer. Plyometric training exercise improve explosive power, muscular strength, speed and quickness, agility, neuromuscular coordination, vertical jump performance, leg strength, muscular power, increase joint awareness and enhance soccer skill performances of the athletes. Plyometric training is widely used in conditioning, power training and in prevention and rehabilitation of injuries in some sports (Roopchand-Martin & Lue-Chin, 2010).

The general objective of this study was to examine the effects of plyometric training on soccer related physical fitness variables of intercollegiate female soccer players. The specific objectives of the study were to diagnosis the effect of plyometric exercises that brought changes on soccer related physical fitness variables of intercollegiate female soccer players, to witness the significance of plyometric training exercises on improving soccer related skills variable among intercollegiate female soccer players and to address the effect of plyometric training that contribute on up-grading soccer related skills to our country's female soccer players.

Materials and methods

Research design

The study was focused on experimental study within 12 weeks of plyometric training exercises to examine soccer related physical fitness variables and soccer skills ability of the participants. For this study informal design was used. The training program was given to the participants for 12 weeks 3 days per week for 40 – 60 minutes per session. The pre-test was given to them to check their initial level and after twelve weeks the post-test were taken to observe the changes.

Sample and sampling techniques

In order to select the samples for this experimental study, purposive sampling techniques was used. The total samples selected for this study were 40; 20 plyometric training group and 20 control group, female soccer players.

Demographic data

Forty female players returned their signed consent forms. All subjects completed the initial evaluation and began the training programme. The mean age of the subjects was 20 ± 1.5 years. Prior to the pre- test, all the players were in-

involved for the test. This resulted in forty female players who completed three months of training and testing. Data were analyzed for the subjects at the end of the three months.

Training protocol

The training program was carried out for 12 weeks. Subjects were trained three times a week. The session included the plyometric exercises for experimental group in which each exercise session involved 15 minute warming up period, followed by at least 20-30 minutes of low to moderate intensity exercise for the first six weeks and gradually increased to high intensity exercises for the last six weeks. The control group was involved only in regular soccer training. The training program was made for the participants and the exercise training was given by the researcher.

Data analysis

The data collected through physical fitness tests and soccer skill tests were analyzed, interpreted and tabulated in to meaningful ideas using manually as well as by SPSS version 20.0 software to compare the selected physical fitness and soccer skill changes observed in the participants. Paired t-test was used to observe the difference from pre to post test results. The level of significance was 0.05%.

Results

Table 1. Mean values of Speed (sec), Agility (sec) and Vertical Jump (cm) for twenty intercollegiate female soccer players (Mean ± SD).

	Experimental		Control	
	PT	PoT	PT	PoT
SP	5.72±0.22	4.94±0.15	5.72±0.22	5.48±0.29
AG	21.48±0.76	18.84±0.90	21.48±0.76	21.00±0.87
VJ	24.75±2.14	32.60±2.74	24.75±2.14	27.00±1.91

Note: values are mean ± SD, SP = Speed, AG = Agility, VJ =Vertical Jump. PT = Pre Training, PoT = Post Training

Table 2. Mean values of Dribbling (sec), Kicking Right Foot (m) and Kicking Left Foot (m) for 20 Haramaya University intercollegiate female soccer players through plyometric training (Mean ± SD).

	Experimental		Control	
	PT	PoT	PT	PoT
DRB	19.96 ± 1.45	18.04 ± 0.90	19.96 ± 1.45	19.34 ± 1.39
KRF	20.76 ± 3.40	22.95 ± 3.05	20.76 ± 3.40	21.30 ± 3.39
KLF	15.44 ± 3.89	18.35 ± 3.11	15.13 ± 3.4	15.91 ± 2.81

Note: values are mean ± SD, DRB = Dribbling, KRF = Kicking Right Foot, KLF =Kicking Left Foot. PT = Pre Training, PoT = Post Training

Table 3. Paired sample t-test results of experimental group parameters.

Variable		MD	SD	t	p
SP	PT -PoT	.78500	.22319	15.729	.000
EP	PT -PoT	-7.85000	2.77726	-12.641	.000
AG	PT -PoT	2.64350	.86665	13.641	.000
DR	PT -PoT	1.91400	.77712	11.015	.000
KRF	PT -PoT	-2.19250	.76662	-12.790	.000
KLF	PT -PoT	-2.90750	1.15796	-11.229	.000

MD= mean difference, SD= standard deviation, SP= speed, EP= explosive power, AG= agility, DR= dribbling, KRF= kicking right foot, KLF= kicking left foot, PT= pre training, PoT= post training

Table 4. Paired sample T-test results of control group parameters.

Variable		MD	SD	t	p
SP	PT -PoT	0.24	0.19	5.597	.000
EP	PT -PoT	-2.25000	1.29	-7.784	.000
AG	PT -PoT	.48000	0.28	7.552	.000
DR	PT -PoT	.61700	0.40	6.865	.000
KRF	PT -PoT	-.54500	0.21	-11.493	.000
KLF	PT -PoT	-.78250	0.58	-6.072	.000

MD= mean difference, SD= standard deviation, SP= speed, EP= explosive power, AG= agility, DR= dribbling, KRF= kicking right foot, KLF= kicking left foot, PT= pre training, PoT= post training

Discussion

Table 1 showed that, the speed, agility and explosive power of participants changed after post training. The mean difference showed that there was an improvement in speed after plyometric training. According to the above data the speed of participants was 5.72 before training and this was improved to 4.94 after progressive endurance training with a mean value difference of 0.78. This study showed that plyometric circuit exercises have an effect on the 30-meter speed run and reduce its time. This result was in accordance with the study that showed because of plyometric circuit exercise, the speed of converting outward contractions into inward contractions increases, and the created tension in the muscle increases as does the production power of the muscle, therefore reducing the duration of the speed run (Faigenbaum et al., 2007; Meylen & Malatesta, 2009; Sedano Campo et al., 2011).

The agility performance was increased from pre training test to post training test. The mean value of agility before training was 21.48 and 18.84 after the training program. After training program 2.64 mean difference was exhibited. Therefore, this result indicated that plyometric training improved agility ability of the participants of the study. A study examined the effects of plyometric training on agility (Miller et al., 2006) showed significant improvements in the Illinois agility test scores after six-weeks of training. The present study also found significant improvements in Agility Scores.

Plyometric training also significantly improved the explosive jumping ability of the participants. The above table indicated that, the mean value difference of explosive power was improved by 7.85. An experimental study conducted on the effects of plyometric and resisted jump-training on speed and explosive power of young athletes showed

the greatest amount of change in vertical jump (Fatouros et al., 2000). Physiological responses to physical training, including plyometric have been well studied by many investigators. It may be expected to positively influence many physical and biochemical functions. In a previous study plyometric training has been shown to be one of the most effective methods for improving explosive power and other physical fitness parameters. A wide variety of athletes can benefit from power training particularly if it follows or coincides with a strength training programme (Potteiger et al., 1999). In accordance with these findings, the present study proved that plyometric training significantly improved selected physical fitness variables on female soccer players.

This improvement was due to the plyometric training they participated in. The graphical representation of mean values of speed, agility and vertical jump of the participants has been exhibited in figure 1.

Table 2 showed that, soccer skills of dribbling, kicking right foot and kicking left foot were changed significantly after post training. The mean difference showed that there was an improvement in dribbling after plyometric training. Before the intervention, the mean difference value of dribbling as shown in the above table was 19.96 and improved to 18.04 after the intervention of plyometric training. This showed that the mean value difference of 1.92 was measured. Therefore, plyometric training significantly improved the dribbling skill of female soccer players. On the other hand there was no improvement for the control group participants. In all the variables the control group participants showed no improvement. The result of this study is in agreement with the study conducted by (Haghighi et al., 2012). Their result showed the time of sprint test and dribbling improved significantly after plyometric training. This study also reported that the skill of dribbling had a positive

correlation with speed and agility on soccer players. In harmony of this study, the present finding significantly improved kicking ability of female soccer players due to plyometric training exercises.

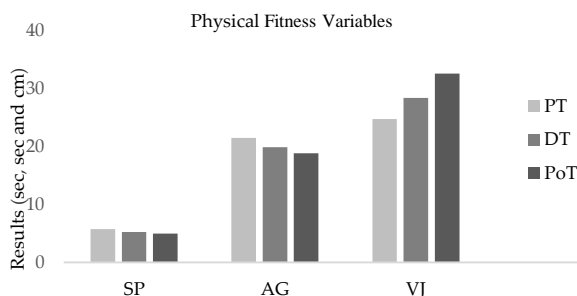


Figure 1. Female soccer players' speed, agility and vertical jump performance throughout plyometric training.

Kicking right and left foot mean values of the participants at baseline and after training are presented in Table 2. The mean value of kicking right foot was increased from pre training test to post training test. The mean value before training was 20.76 which improved to 22.95 after the training program. After training program 2.19 mean value difference was recorded. Therefore, this result indicated that plyometric training improved kicking right foot ability of the participants of the study. Plyometric training also significantly improved the kicking ability of left foot of the participants. The above table indicated that, the mean value difference of 2.91 was measured after the plyometric training program.

The study conducted on the effects of plyometric training in improving the kicking performance of soccer players, reported that an implication of the positive relation between leg explosive power and kick performance was observed after 12 weeks of plyometric training. It seems that, given a certain level of technique, plyometric training added to the normal soccer training improved both muscular strength and kick performance of female soccer players (De Proft et al., 1988). A meta-analytical study suggested that there may be positive effects of plyometric training on vertical jump ability to other athletic performance, which could include kicking ability of soccer players (Markovic, 2007). This improvement was due to the plyometric training they were engaged in. The graphical representation of mean values of speed, agility and vertical jump of the participants has been exhibited in figure 2.

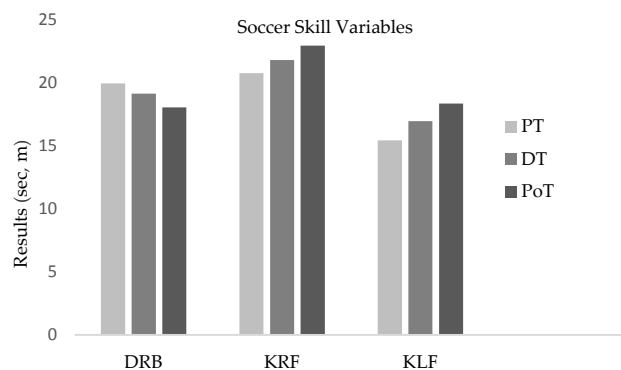


Figure 2. Female soccer players' dribbling, kicking right foot and kicking left foot throughout plyometric training.

Conclusion

With the possible limitation of the study, the following conclusions were made:

- Plyometric training program have shown significant improvement on speed performance of intercollegiate soccer players by reducing the time to cover the distance.
- Plyometric training greatly evoked the University female intercollegiate soccer player's kicking skill performances by increasing their kicking abilities for distance.
- The program also improved agility and explosive power of the University female soccer players.
- At the end of the study period the dribbling skill of the players in relation to time showed reduction when compared to the pre training test. Therefore, it is possible to conclude that plyometric training improved the dribbling skill of intercollegiate female soccer players.
- The program has also shown significant change in improving the selected variables of physical fitness components and soccer skill variables.

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